Hypovolemic Shock Management

COMBAT MEDIC ADVANCED SKILLS TRAINING (CMAST)

Introduction

- One of the most critical skills for the soldier medic.
- Without proper airway management and ventilation techniques, casualties may die.
- Must be able to choose and effectively utilize the proper equipment for ventilation in a tactical environment.

Fluid Resuscitation

- Control hemorrhage first.
- Casualties with significant injuries should have a single 18 ga IV with saline lock in a peripheral vein initiated.
- Casualties without significant injuries do not need an IV but should be encouraged to drink fluids.

Saline Lock Kit

Click on picture for video

Saline Lock

Click on picture for video

Saline Lock

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Saline Lock

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Saline Lock

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Fluid Resuscitation

- If unable to start a peripheral IV consider initiating a sternal I/O.

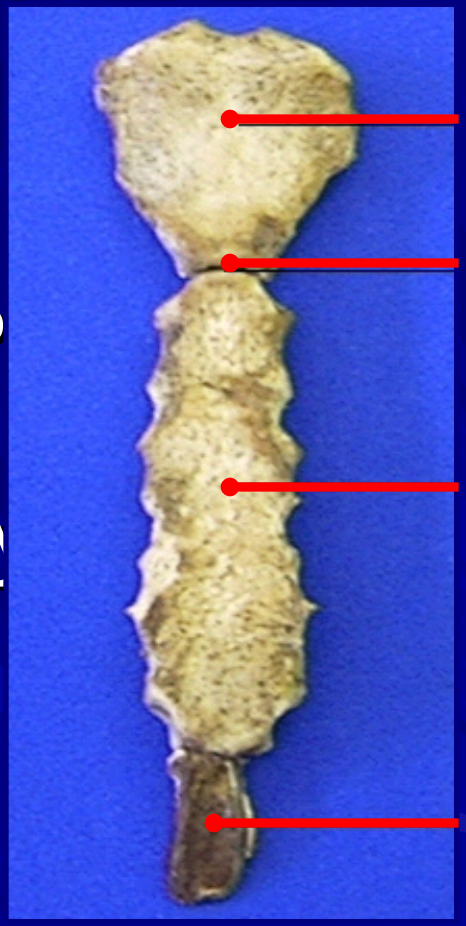
F.A.S.T.1

F.A.S.T.1

Click on picture for video

Intraosseous Access

- Sternal vs. tibial.
- Majority of wounds are extremity wounds (> 60%
- Tibial cortex is very thick.
- Sternum protected by body armor.
- Sternum is uniform from person to person.



Intraosseous Access

- Indications:
  - Inadequate peripheral access
  - Need for rapid access for medications, fluid or blood
  - Failed attempts at peripheral or central venous access

Intraosseous Access

- Typical protocol precautions:
- F.A.S.T.1 not recommended if:
  - Casualty is of small stature:
    - Weight is less than 50 kg.
    - Pathological small size
  - Fractured manubrium/sternum - flail
  - Significant tissue damage at site
  - Severe osteoporosis
  - Previous sternotomy and/or scar

Flow Capabilities

- 30 ml/min by gravity.
- 125 ml/min utilizing pressure infusion.
- 250 ml/min using syringe forced infusion.

Administering Blood

- Blood is 4 times more viscous than NaCl.
- Result is 1/4 normal rate of flow when administering blood using gravity.
- Infusion catheter internal pressure during gravity infusion = ~75 mmHg.
- Catheter can take up to 1,500 mmHg.
- Solution?
  - Use pressure infusion

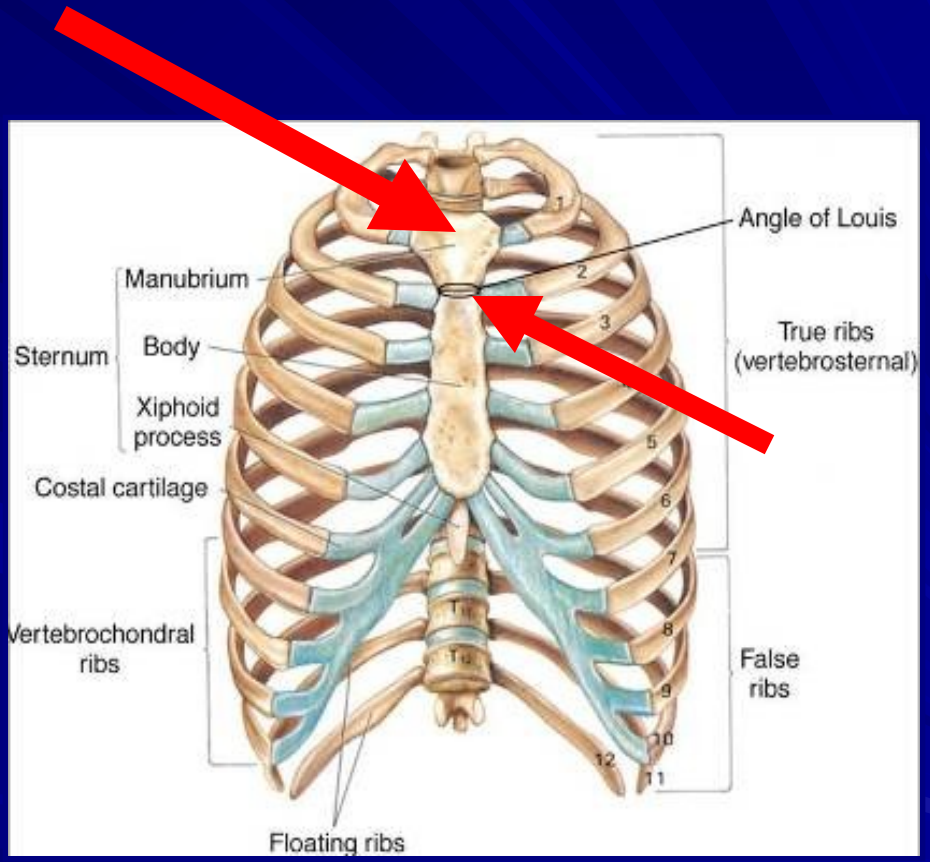
F.A.S.T.1 is considered a short-tem device and should not to be left in place for ≥ 24 hours.

Perpendicular Insertion

- F.A.S.T.1 must be inserted perpendicular to the surface of the manubrium.
- Device penetrates bone only 6 mm.
- Perpendicular relationship to the surface of the manubrium critical for catheter to enter marrow space.
- Rich vasculature drains manubrium... F.A.S.T.1 is equivalent to a peripheral IV.

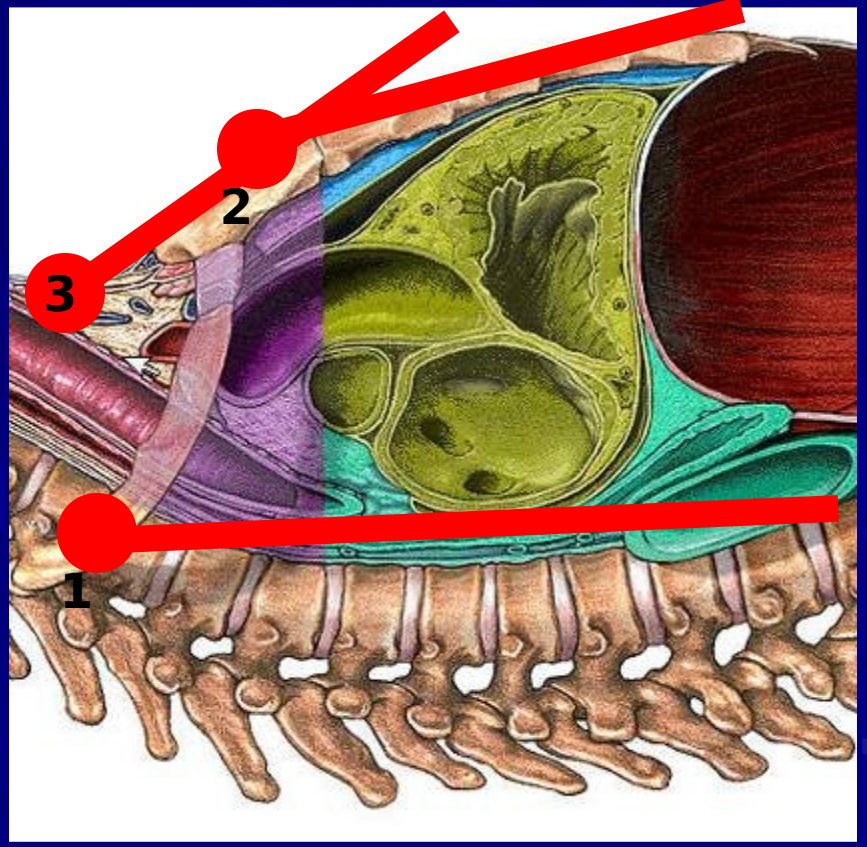
Perpendicular Insertion

- Confirm landmarks:
  - Manubrium is upper aspect of sternal structure
  - Articulates with body of sternum at the “Angle of Louis”



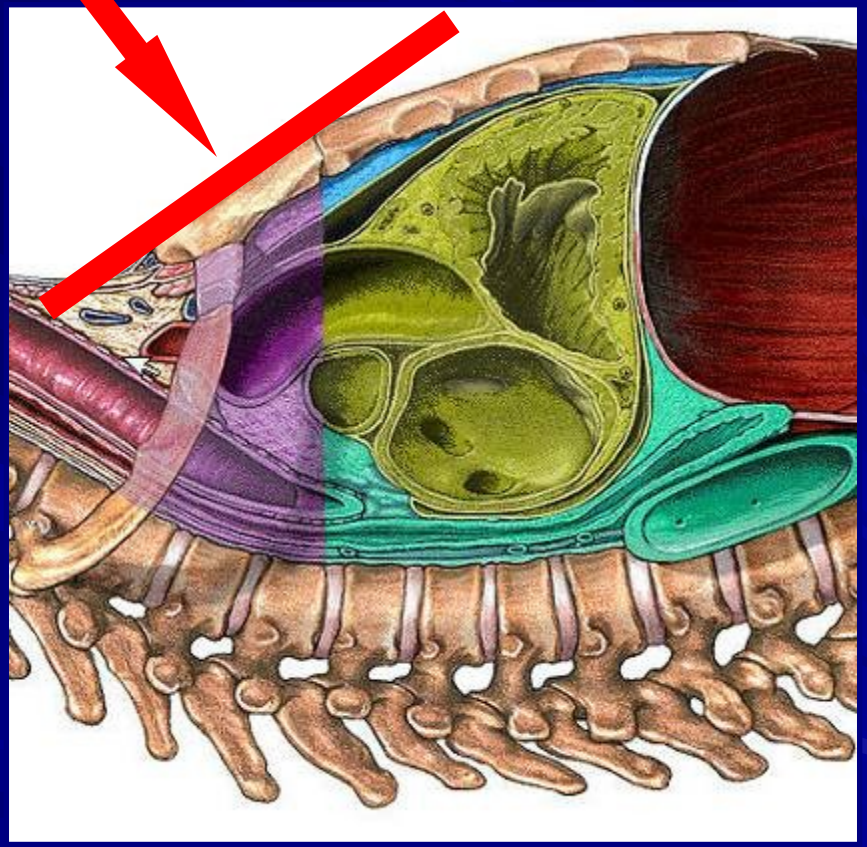
Perpendicular Insertion

- Note that there are three planes relative to the casualty:
  1-Surface of ground
  2-Surface of body of the sternum
  3-Surface of the manubrium



Perpendicular Insertion

- Manubrium surface angle is your point of focus.
- Perpendicular means at right angles to the surface of the manubrium.



F.A.S.T.1 Procedure

- Procedure:
  - Prepare site using aseptic technique
    - Betadine
    - Alcohol

F.A.S.T.1 Procedure

- Insertion:
  - Finger at suprasternal notch
  - Align finger with patch indentation
  - Emplace patch

F.A.S.T.1 Procedure

- Insertion:
  - Place introducer needle cluster in target area
    - Assure firm grip
    - Introducer devic must be perpendicular to the surface o manubrium

F.A.S.T.1 Procedure

- Insertion:
  - Insert using increasing pressure till device releases (~20-30 pounds)

  NOTE: If more force than that is needed, it's not perpendicular)
  - Maintain perpendicular alignment to th manubrium throughout

F.A.S.T.1 Procedure

- Insertion:
  - Following device release, infusion tube separates from introducer
  - Remove introducer by pulling straight back
  - Cap introducer using post-use cap supplied

F.A.S.T.1 Procedure

- Insertion:
  - Connect infusion tube to tube on the target patch
  - Assure patency by use of syringe administer 5 ml blast of saline
    - Clears any tissue debri the i c

F.A.S.T.1 Procedure

- Insertion:
  - Connect IV line to target patch tube
  - Open IV and ensure good solution flow

F.A.S.T.1 Procedure

- Insertion:
  - Emplace the dome over the site

F.A.S.T.1 Procedure

- Insertion:
  - Be certain that remover device is attached to (and transported with) the casualty

F.A.S.T.1 Procedure

- Problems areas:
  - Infiltration - usually due to insertion not being perpendicular to the manubrium
  - Inadequate flow or no flow -
    - Infusion tube occluded
    - 1 ml saline flush recommended
    - Infusion catheter inserted at other than a perpendicular angle to the manubrium surface

F.A.S.T.1 Procedure

- Removal procedure:
  - Stabilize target patch with one hand
  - Remove dome with the other

F.A.S.T.1 Procedure

- Removal procedure:
  - Terminate IV fluid flow
  - Disconnect infusion tube

F.A.S.T.1 Procedure

- Removal procedure:
  - Hold infusion tube perpendicular to the manubrium
  - Maintain slight traction on the infusion tube
  - Insert the remover while continuing to hold infus tube in slight tractic

F.A.S.T.1 Procedure

- Removal procedure:
  - Advance remover
  - THIS IS A THREADED DEVICE
  - Gentle counterclockwise movement at first may h in seating remover
  - Make sure you feel the threads seat

F.A.S.T.1 Procedure

- Removal procedure:
  - Turn it clockwise until remover no longer turns
  - This firmly engages remover into metal (proximal) end of the infusion tube

F.A.S.T.1 Procedure

- Removal procedure:
  - Remove infusion tube
  - Use only “T” shaped knob and pull perpendicular to the manubrium
  - Hold target patch during removal
  - DO NOT pull on the Luer fitting or the tube itself

F.A.S.T.1 Procedure

- Removal procedure:
  - Remove target patch

F.A.S.T.1 Procedure

- Removal procedure:
  - Dress infusion site using aseptic technique
  - Dispose of remover and infusion tube using contaminated sharps protocol

F.A.S.T.1 Procedure

- Removal procedure:
  - Problems encountered during removal
    - Performed properly…should be none!
    - Be certain threads on remover engage threads at distal end of infusion catheter
    - Moving remover around with tip as axis while in the infusion catheter may shear off end of removal tool

F.A.S.T.1 Procedure

- Removal procedure:
  - If removal fails or proximal metal ends separates:
    - Anesthetize with local - make small incision
    - Remove using clamp and close as appropriate

    NOTE: This is “serious injury” as defined by the FDA and is a reportable event

Intravenous Solutions

- Different types of IV fluids can be used for different medical conditions

- Generally categorized as:
  - Colloid or Crystalloid

Colloids

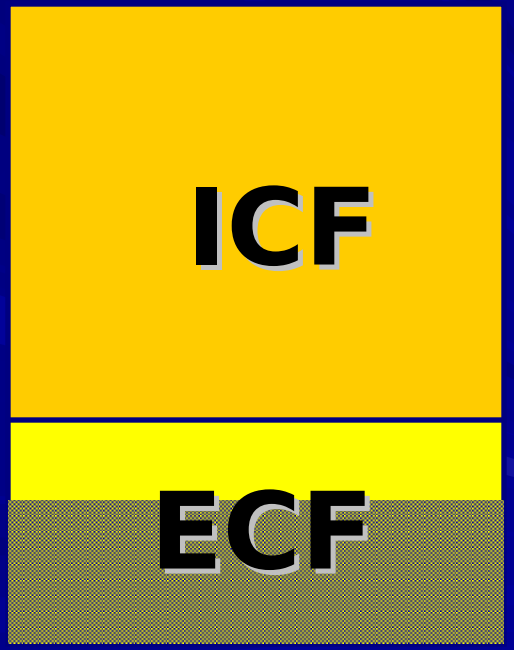
- Contain protein, sugar or other high molecular weight molecules; used to expand intravascular volume.
  - Whole blood (most common)
  - Packed red blood cells
  - Fresh frozen plasma
  - Plasma Protein Fraction
  - Hypertonic Saline & Dextran (HSD)
  - Hextend is a 6% hetastarch solution in a balanced electrolyte solution

Crystalloids

- Solutions that do not contain protein or other large molecules; sodium is the primary osmotic agent.
- These fluids do not remain in the vascular system very long.
  - Normal Saline (NS, 0.9% NaC
  - Lactated Ringers (LR)

Fluids

- Fluid distribution.
  - Intracellular space = 2/3 of body weight.
  - Extracellular space = 1/3 of body weight.
    - Interstitial space 80%
    - Vascular space 20%



Fluids

- 1,000 ml of Ringers Lactate (2.4 lbs) will expand the intravascular volume by

  200-250 ml within 1 hour.

- Why only 200-250 ml left?

  – Sodium diffuses out of the blood vessels into the extravascular (interstitial) space rapidly.

Hextend

- 500ml of Hextend® weighs 1.3lbs will expand the intravascular volume by 800ml within 1 hour, and will sustain this expansion for 8 hours.
- How does this happen?
- Large sugar molecule-pulls fluid from the extra vascular (interstitial) space into the vessels.

Fluids

- One liter of Hextend = 6-8 liters of RL.
- Is it a better resuscitation fluid?
- No, it is better for hypovolemia because of its weight and cube advantage for the soldier medic.
- Ringers lactate is better for dehydration.
- Soldier medics must carry some of each.

Resuscitation Indicators

- How do you determine who needs fluids?
- Blood Pressure.
- Peripheral (radial) pulse.
- Can BP be measured in a combat environment?
  - Helicopters
  - Tracks
  - 

Hypotensive Resuscitation

- Casualties should only be resuscitated to a blood pressure of 80 mmHg.
- If blood vessels have clotted can you raise the blood pressure high enough to pop the clot off?
  - YES at a BP of @ 93 mmHg

Resuscitation Indicators

- The systolic blood pressure may be approximated by palpating specific pulses:
  - Palpable carotid pulse = 60 mmHg
  - Palpable femoral pulse = 70 mmHg
  - Palpable radial pulse = 80 mmHg

Fluid Resuscitation

- Superficial wounds (>50% injured); no immediate IV fluids needed. Oral fluids should be encouraged.

Fluid Resuscitation

- Any significant extremity or truncal wound (neck, chest, abdomen, pelvis).
- If the casualty is coherent and has a palpable radial pulse (BP 80 mmHg), initiate a saline lock, hold fluids and reevaluate as frequently as the situation permits.

Fluid Resuscitation

- If casualty has a palpable radial pulse, why initiate a saline lock?
  - By establishing intravenous access now, when they have an adequate BP, it is easier than when they have a lower/absent BP.

Fluid Resuscitation

- Significant blood loss from any wound, and the soldier has no radial pulse or is not coherent -*STOP THE BLEEDING*- by whatever means available - tourniquet, direct pressure, hemostatic dressings, or hemostatic powder etc.

- Start 500 ml of Hextend®. If mental status improves and radial pulse returns, maintain saline lock and hold fluids.

Fluid Resuscitation

- If no response is seen give an additional 500 ml of Hextend® and monitor vital signs. If no response is seen after 1,000 ml of Hextend®, consider triaging supplies and attention to more salvageable casualties.

- Why?
  - Resources: How many more casualties do you have and how much fluid is available?

Fluid Resuscitation

- If casualties are not resuscitated with 1,000ml of Hextend they are probably still bleeding. If excess fluids are given they will die faster than a casualty who received no fluids.
- Why? Increased BP and coagulation factors diluted as BP rises hemorrhage increases
- Why then does ATLS recommend 2 large-bore IVs and fluid run wide open? The transit time to definitive care is only a few minutes.

Why does hypothermia happen?

Hypothermia

- Casualties who are hypovolemic quickly become hypothermic.
- Body temperatures below 91° F causes the vicious triad.
  - Hypothermia
  - Acidosis
  - Coagulopathy

Hypothermia

- When this vicious triad occurs the casualty's blood will not clot.

- Prevention is the best method.

Field Expedient Warming

- Warm IV fluids in cold environment.

Hypothermia

- Prior to evacuation, casualties must be wrapped in a blanket to prevent heat loss during transport (even if the temperature is 120° F) especially true with air evacuation

Hypothermia Prevention and Management Kit™

Hypothermia Prevention and Management Kit™ (HPMK) Ready for Transport

6 – Cell

"Ready-Heat" Blanket

4- Cell

"Ready-Heat" Blanket

Blizzard *"Survival Wrap*

Summary

- Identify hypovolemic shock.
- Ensure hemorrhage control first.
- Provide treatment for hypovolemic shock using hypotensive resuscitation principles.

Questions?